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DEPARTMENT OF COMMERCE

BUREAU OF STANDARDS

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GENERAL NOTE.

Owing to the current nature of the investigations mentioned in the Technical News Bulletin, sometimes it will be impossible to supply printed information regarding them. However, in these cases, when the investigation has progressed sufficiently far, the Bureau will be pleased to furnish technical data to those engaged in the particular application of the subject, in order to avoid the delay incident to publication.

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1 Standard Radio Wavemeter

The Radio Section of the Bureau is called on to test for government agencies, commercial and university laboratories, and others a great variety of radio material, especially wavemeters. Not only in connection with radio communication, but also in a wide and growing field of electrical research, there is an insistent demand for accurate measurement of the wave length or frequency of rapidly alternating currents. In the standard wavemeter most recently designed by the Bureau, careful attention has been given to the electrical and mechanical considerations which make for accuracy, especially rigidity of construction, and precision of set and reading. This wavemeter, when calibrated, will be capable of measuring wave lengths from 65 to 85,000 meters, or in terms of frequency from 3,500 to 4,600,000 cycles per second.

A typewritten description of this wavemeter has been prepared and is available for distribution to interested persons.

2 Design of Atmospheric Burners

The Bureau of Standards has carried on an extensive investigation of gas burner design intended primarily for the benefit of manufacturers of gas appliances and industrial gas appliance engineers.

The results of this work are given in Technologic Paper No. 193 of the Bureau of Standards which is now for sale by the Superintendent of Documents.

In this paper no extensive presentation of theory has been attempted, the aim being rather to show by means of tables and curves based on experimental data the effect of various factors on the operation of burners. With the arrangement of apparatus and method of testing that has been developed, it is possible to measure quickly and accurately the volume of air injected into any burner under any condition of operation, as well as to determine the limits of operation with any quality of gas. Such information is essential in order to determine the limits of operation with any quality of gas. Such information is essential in order to enable one to design burners for any predetermined condition of operation. In order to understand the various factors entering into the design of burners, it was found necessary to study the theory of the flow of gas through different types of orifices, the principles governing the rate of injection of air into the burner, the design of the injecting tube, the rate of consumption of burners of different port areas, and the effect of adjustment of the air shutter. These various factors are taken up in detail.

In conclusion it is pointed out that on account of its simplicity, low cost, and reliability, the atmospheric gas burner is well adapted for domestic and most of the smaller industrial purposes. If it is possible to widen the range within which such burners can be operated efficiently and without adjustment, and design them to meet the needs of any particular purpose, it will make gas fuel much more valuable and will broaden its field of application. With this in view, the Bureau has been conducting experiments on atmospheric burners both with natural and artificial gas and the results will be reported in subsequent papers.

3 Tests of Town-Border Gas Meters

Recently the Bureau has been called upon to test the town-border meters of one of the gas companies in Texas. A thorough investigation was made and a report covering tests of 63 of these meters, 1 test meter, and 1 flow meter has been forwarded to the company interested. A discussion of the company's metering equipment and suggestions for improvement were included. This report, besides giving the general condition of the meters at the time of test, shows that meters of the type tested may be depended upon to give results of reasonable commercial accuracy and to aid in the detection of losses by leakage of gas between the town-border meters and the consumers' meters.

4 Standard Specifications for Large Incandescent Electric Lamps

For about 14 years electric lamps have been purchased by the federal government under specifications published in Circular 13 of the Bureau of Standards. Progress in the art of lamp manufacture has been so rapid that this circular has had to be revised eight times in order to keep the specifications abreast with current developments.

The 9th edition of this circular has just now been published and may be obtained at 5¢ per copy from the Superintendent of Documents, Government Printing Office, Washington, D. C. The original specifications covered only carbon filament lamps while in the later editions metallized carbon and tantalum lamps were introduced and then discarded as tungsten replaced them in use. In connection with these radical changes in types of lamps, very great improvements were made in the efficiency and the life required, but no fundamental change was made in the form of the specifications or methods of testing. However, for the fiscal year beginning July 1, 1921, new specifications have been adopted which include important changes in the test procedure for tungsten lamps. The most notable of these changes is the abandonment of the long-established provision that the life of test lamps shall be considered as ended when the candlepower has fallen to 80% of the initial value. Now the life is considered as the total life of the lamp since the efficiency of tungsten lamps drops but very little up to the point of burn-out. The performance of a lamp throughout its life will also be taken into account and tolerances are provided to care for possible variations in test results where only a small number of samples of any one order are available.

Tests under these new specifications are intended to give a more complete indication of the performance of lamps than was the case with the former specifications and while prepared primarily for use by the departments of the government in purchasing incandescent lamps, it seems desirable on account of the thoroughness with which the subject has been studied and discussed to make the specifications available for the general public. It is for this reason that they are being used as the 9th edition of Circular 13.

Criticisms and suggestions concerning these specifications and lamp ratings are invited from both manufacturers and users and all such suggestions will be carefully considered in the event of a further revision of the specifications.

5 Testing of Thermometers

The previous edition of this circular of the Bureau of Standards contained in addition to the testing regulations much general information on thermometry and temperature measurements. The present or third edition of Circular No. 8 has been very much shortened by including only the information which is essential to those who avail themselves of the Bureau's testing facilities. The Bureau's standard scale of temperature is defined and the method of reproducing it is briefly indicated. A new feature of the circular is the inclusion of definite testing requirements and of tolerances as to correctness of graduation. Thermometers meeting the requirements as to suitable design, material, and workmanship will, if found correct within the established tolerances, be certified, others will receive reports giving the results of the test. Notes on the behavior of thermometers which are included in the circular are intended to give the user of these instruments the information necessary for an intelligent application of the results of the test. Explanations are given of the reasons why the applicant for test must assume all risk of breakage either in shipment or test. The circular contains general instructions concerning packing and shipping and schedule of fees for testing.

6 Fire Tests of Building Columns

In cooperation with the Associated Factory Mutual Fire Insurance Companies and the National Board of Fire Underwriters, the Bureau of Standards has conducted a very thorough investigation of the fire-resistance of building columns and has recently issued Technologic Paper No. 184 on this subject which is for sale at 75¢ per copy by the Superintendent of Documents.

The fire exposure test was produced by placing the column in a gas-fired furnace at the same time the predetermined working load for the column being maintained constant during the test. In certain cases not only the resistance to fire but resistance to fire and water was investigated. In this case the column was loaded and exposed to fire for a predetermined time after which the doors of the furnace were opened and a hose stream applied to the heated column, the severity of the test being regulated by the degree of resistance developed by the corresponding type of column in the regular fire tests. The paper reports 106 tests of columns of which 91 were fire tests and 15 fire-and-water tests.

In the case of columns protected by a fire-resisting material, the latter was obtained from the main producing regions of the country, in order to secure truly

representative material. Care was taken in erecting the columns and coverings to duplicate as nearly as possible actual building practice. The test results are presented in 12 tables and 128 figures and diagrams, the latter comprising views of the columns before and after test, the time-temperature curves for the furnace, and numerous points on the test column as well as unit deformation with corresponding average column temperature curves.

The results are summarized in terms of hours and minutes of fire resistance offered by the different types of columns and protection. The resistance period is taken as 2/3 of the average time to failure in the fire tests, the deduction being made to allow for incidental variations in material and workmanship of columns and coverings as tested and as installed in buildings and also for differences in load and fire construction.

The resistance periods thus derived vary from 10 minutes for unprotected steel columns to 8 hours for similar columns covered with a 4-inch thickness of concrete made with fire-resistive aggregates and reinforced concrete columns made with the same aggregates. The series covers quite well the range of current practice in structural steel columns and perhaps also in proportion to the extent of their use. The studies made on effect of size indicate that the results obtained with the columns tested which were representative of the smaller sizes in use can be extended with safety to large columns.

7 Method for Obtaining Color Value of Sugar Solutions

For some time an investigation has been in progress of the fundamentals of technical colorimetry. Many sugar solutions, such as molasses, contain so much coloring material that they are too dark to be read on color-measuring instruments even when the thickness of the layer used is decreased as much as is practicable. Dilution of such heavy, dark-colored solutions with water causes some change to take place resulting in a flocculation and precipitation of a part of the coloring material which is present in the undiluted solution. This precipitated material is so fine that it does not settle and, therefore, renders the solution turbid. If this turbid solution is used to determine the color value of the original dark-colored solution, an error is caused by the dispersion or scattering of the light by the fine precipitated particles. If these particles, which are known scientifically as dispersoids, are filtered off and the remaining clear liquid used, an error is likewise made since a part of the coloring matter which was originally present has now been removed.

A new method for the measurement of the color value of sugar solutions is being developed in which the above

errors are avoided. The method consists essentially in diluting the dark-colored solution in a concentrated sugar syrup of known color value. The dilution with water decreases the protective influence of sucrose which acts as a protective colloid while the dilution with concentrated granulated syrup maintains the same state of equilibrium and prevents the precipitation of the coloring material. Beer's law is valid only as long as flocculation and change in color value are prevented. If laboratory practice invalidates the law, truthful results cannot be obtained. This fact has been ignored by technical sugar chemists up to the present time. The basic principles of technical colorimetry stated by Stammer, long before the days of colloidal chemistry, have never been tested under more modern conditions.

8 Determination of Raffinose

A modification of the enzyme method for determining raffinose has been devised which permits a high degree of accuracy without the necessity of making precise polarizations in the presence of large amounts of invert sugar. The method depends upon the fact that melibiose which is formed from raffinose is quite immune to fermentation by ordinary yeast. It is thus possible to remove the greater part of the invert sugar and to determine the melibiose accurately by means of the enzyme extracted from brewers' yeast. Determinations of melibiose are made by estimating reducing sugars before and after hydrolysis. Three samples of discard molasses from Colorado were analyzed by the above method and by the Clerget method which is described in Scientific Paper 375 of this Bureau. From the analytical data, it was concluded that the true raffinose is sometimes less and sometimes greater than that calculated by the Clerget analysis.

9 Metallographic Testing

A second edition of Circular 42 of the Bureau of Standards has been issued on this subject and may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C.

The value of the results of the metallographic examination as related to the testing of metals is now generally recognized. While the mere determination of certain mechanical properties may be sufficient in routine testing, for a complete working knowledge of metals and alloys a much more extensive study, particularly of the conditions which determine the properties, is necessary. The study of these fundamental conditions, structure, constitution, mechanical and thermal treatment, etc., constitutes the subject of metallography, using the term in its broad sense and not limiting it to microscopic examination as was formerly the custom.

The circular describes briefly the conditions which affect the properties of metallic materials under the following headings: Microscopy and structure; thermal analysis and heat treatment; mechanical working of metals; chemical and metallurgical factors, and conditions of melting.

The circular summarizes the conditions under which metallographic tests will be conducted by the Bureau, and specific directions concerning shipping, assembling, etc., are given.

10 Zinc Cyanide Plating Solutions

Zinc coatings furnish by far the best protection against corrosion of steel and for this reason zinc plating or electrogalvanizing was extensively applied to all sorts of machinery during the war. Satisfactory zinc deposits can be secured from either sulphate or cyanide solutions but the latter possesses the advantage of "throwing" the deposit better into deep depressions or upon the surface of irregularly shaped articles. The cyanide solutions were, therefore, given first consideration in the investigations conducted by the Bureau. It is hoped later to extend this study to include the sulphate solutions. It was found that satisfactory zinc cyanide plating solutions can be made by using zinc oxide to replace part or all of the zinc cyanide formerly employed for this purpose.

Technologic Paper No. 195 of the Bureau of Standards describes the above work and gives formulas for satisfactory solutions and general directions for their use.

11 The Bureau's Representation at National Exhibition of Chemical Industries

Considerable time was devoted to preparing an exhibit which was one of the interesting features of the National Exposition of Chemical Industries held in New York early in September. A member of the Bureau's staff was in charge of the booth and the exhibits themselves were prepared under the direction of the Chemistry Division. It is estimated that at least 10,000 people spent more or less time in looking over the exhibit and it is believed that the information thus gained will give the public a better idea of the work of the Bureau of Standards.

12 Revision of Paint Specifications

The Interdepartmental Committee on Paint Specification Standardization met on September 12 and recommended a revision of Bureau of Standards Circular 103 "Recommended Specification for Spar Varnish". The committee also recommended a new specification entitled "Recommended Specification for Interior Varnish" which will be published as Bureau of Standards Circular 117. These manuscripts will be sent to the printer as soon as possible and in the meantime advance copies have been furnished to Mr. H. A.

Gardner who will probably have them printed for private distribution for the benefit of manufacturers interested.

13 X-Rays from Arcs in Gases and Vapors

A paper entitled "Soft Characteristic X-Rays from Arcs in Gases and Vapors" by Mohler and Foote was published in the Journal of the Washington Academy of Sciences, vol. 2, page 273, 1921.

The investigations on which this paper is based were conducted in the high temperature laboratories of the Bureau and it is expected that a more detailed publication on the subject will later be issued by the Bureau.

14 Physical Properties of Pure Platinum

The Chemical Division of the Bureau, in cooperation with the Heat and Optical Divisions, has developed methods of obtaining platinum and some of its alloys in a state of extraordinarily high purity. A very sensitive test for the purity of platinum is afforded by the measurement of its "fundamental coefficient", that is, the mean change of resistance per degree Centigrade in the interval $0^{\circ}$ to $100^{\circ}$C. Some measurements of the fundamental coefficient of this recently produced platinum wire have shown values as high as 0.003922. The highest hitherto recorded value of this coefficient was 0.003917.

15 Low Pressure Safety Valve

Safety valves designed for low pressure are important for certain uses. It is desirable that such valves open at a predetermined pressure and close after a certain drop in pressure and seat tightly so as to minimize leakage. A new form of safety valve to fulfill these requirements has been designed and constructed, one such valve having been supplied to the Air Service for use on a liquid oxygen container. Anyone interested in the construction of this valve may obtain information concerning it by writing the Bureau.

16 Tests of Manila Rope

The Bureau of Standards has recently issued Technologic Paper No. 198 on this subject. It is ready for distribution by the Superintendent of Documents, Government Printing Office, Washington, D. C.

The results of tests on manila rope discussed in this paper represent some of the data which have been accumulated at the Bureau during the past few years. Most of the specimens were submitted by various rope manufacturers on purchase orders for government departments and a fixed procedure was adopted by the laboratory in testing all of them. The rope ranged in diameter from 1/2 to 4-1/2 inches inclusive and consisted of commercial 3-strand, regular lay ropes. The breaking load, weight per linear foot, number of yarns, and the lay of the rope and strands, as well as

the elongation, were measured. The average breaking load was found to be approximately a quadratic function of the diameter of the rope. It is expressed quite closely by the equation

$$L = cd(d+1)$$

in which L is the load in pounds, c is a constant equal to 5000, and d is the diameter of the rope in inches. The ropes showed a continually varying modulus of elasticity and no well-defined proportional limit. The number of yarns composing a rope may be expressed approximately by the equation

$$N = kd(d+0.4)$$

where N = the number of yarns, k is a constant equal to 50, and d the diameter of the rope in inches.

The test results cover sufficient range and show such consistency that it is believed that the formulas deduced may be safely used for 3-strand regular lay manila rope of sizes between 1/2 and 4-1/2 inches in diameter.

17 Specifications for Fire Hose

Circular 114 of the Bureau of Standards is concerned with specifications for fire hose drawn up by the Bureau for use by government departments. The specification was submitted to the Rubber Association of America and has received the official endorsement of the technical committee on specifications. The hose purchased under the requirements of this specification is cotton lined and the types included are single-jacketed hose for use at fire hydrants, stand pipes, and similar places; double- and triple-jacketed hose for use on pumping engines and in places where additional wear requires the increased protection afforded by the extra cotton jacket. The chemical and physical tests to which the hose must conform are described in detail. The strength of the cotton jacket is insured by the requirements for certain measurements to be made on the finished hose when under hydraulic pressure. The brass couplings are governed by the requirements of the compositions of the alloys.

18 Standardization of Paper

A conference has just been held at the Bureau at which the standardization of paper was discussed by representatives of manufacturers, printers, and users of this material. A program for the meeting had been prepared which consisted of 7 parts as follows: (1) Classification; (2) Definition and Nomenclature; (3) Simplification of Sizes and Quality; (4) Specifications; (5) Testing and Sampling; (6) Tolerances, and (7) Procedure for Revision.

It was found inadvisable to attempt to obtain any definite recommendations from this preliminary conference and it was decided that it would be better to have a committee appointed for each of the above phases of standardization. These committees are in process of formation and will in most cases consist of representatives of associations or trade organizations who will prepare reports and recommendations to this Bureau. The exact personnel of these committees cannot be stated at this time but it is hoped that progress in this important work can be reported in the near future.

19 Specifications for Glass Tableware

The Bureau of Standards has prepared specifications for tumblers for use by the Army and the Marine Corps. These specifications were submitted to these departments and have been accepted by them as representing their requirements. They will now be sent to manufacturers and dealers for criticism. These new specifications allow the purchase of machine-made tumblers as well as those made by hand, thus making possible a considerable reduction in cost and providing for a standard size to be used by both the Marine Corps and Army.

20 Specifications for Enameled Ware

The Bureau is interested in the standardization of sizes of enameled ware and in this connection a number of representative manufacturers of cast iron ware have submitted samples for test to the laboratory. A representative of the Bureau made a trip to Baltimore, Newark, and New York in connection with this work and interviewed a number of manufacturers and purchasers on the subject of specifications. The manufacturers appear to be willing to take part in a conference on this subject, although they realize that the standardization of sizes will involve considerable cost in changing of dies. It has been suggested to them that such a change will necessarily take place over a considerable period of time so that the cost will not be excessive.

The Enameled Ware Purchasing Department of a very large corporation showed a keen interest in the work which the Bureau has under way, since they had themselves attempted to establish standards previous to the war. A number of letters have been sent to various purchasers and jobbing houses dealing with enameled ware in the Chicago and Detroit district and with one exception all have shown a keen interest in the standardization of sizes and quality. As soon as some data have been obtained on the ware which has been received, a conference of the interested parties will be called at the Bureau.

21 Equipment for Testing Automobile Brake Linings

The work now under way at the Bureau in developing standard tests for automobile brake linings has been mentioned previously in the Bulletin. Blue prints have been prepared for the equipment developed for this work and copies sent to manufacturers of lining so that they can construct similar equipment for their own use. In this way it is hoped to standardize the testing of this important class of material among automotive manufacturers.

22 Weights Constructed of Magnetic Material

A few months ago in investigating three imported sets of analytical weights, it was found that the weights from 0.5 to 0.05 of a gram were made of a decidedly magnetic material. During the past month a similar set, several years old, was likewise found to have magnetic weights which caused great irregularities when an attempt to calibrate them was made. Weights of this character can be readily detected by using a small magnet and it is well for purchasers of analytical weights to be on their guard against them as under some circumstances serious errors may be introduced by using such weights.

Respectfully,

S. W. STRATTON

Director
HGB